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Monika Sood
Division of Food Science and Technology, Faculty of Agriculture, SK University of Agricultural Sciences and Technology of Jammu, Chatha, Jammu, Jammu & Kashmir, India

Julie D Bandral
Division of Food Science and Technology, Faculty of Agriculture, SK University of Agricultural Sciences and Technology of Jammu, Chatha, Jammu, Jammu & Kashmir, India

Manmeet Kaur
Division of Food Science and Technology, Faculty of Agriculture, SK University of Agricultural Sciences and Technology of Jammu, Chatha, Jammu, Jammu & Kashmir, India

Correspondence
Monika Sood
Division of Food Science and Technology, Faculty of Agriculture, SK University of Agricultural Sciences and Technology of Jammu, Chatha, Jammu, Jammu & Kashmir, India

Development and quality evaluation of jamun seed powder supplemented noodles

Monika Sood, Julie D Bandral and Manmeet Kaur

Abstract
Jamun seed powder has been used for centuries as a natural form for balancing the healthy blood sugar level, control cardio-vascular and gastro-intestinal disorders. Therefore, an attempt has been made to utilize this nutritive jamun seed powder in value added product, thus reducing the wastage. The wheat flour was blended with jamun seed powder in the ratios of 2, 4, 6, 8 and 10 per cent for the development of noodles. The developed products were stored for 90 days to ascertain the changes in cooking characteristics, proximate composition and sensory parameters. The cooking properties were altered by the addition of jamun seed powder. Cooking time, weight increase and volume increase showed an increasing trend with the incorporation of jamun seed powder from 9.98 to 11.01 minutes, 141.42 to 174.52 per cent and 140.00 to 210.00 per cent, respectively. On the basis of sensory evaluation, noodles prepared from 8 per cent jamun seed powder were adjudged the best with regard to their acceptability and storability having crude protein, crude fat, crude fibre and ash content of 10.89, 0.60, 1.43 and 0.91 per cent, respectively.

Keywords: Jamun seed powder, cooking, protein, fibre, crude fat, sensory parameters

1. Introduction
Noodle is a form of pasta that is becoming extremely popular in India. Instant noodles are prepared by means of an extrusion machine. These products can be described as hard brittle pieces formed into thread like structure by extruding, cutting and drying tough dough. Instant noodles are consumed in more than 80 countries and have become internationally recognized food. Noodle industry supplies 95.4 billion servings annually to consumers throughout the world and the demands are on the rise. According to the World Instant Noodle Association, China ranks first in the consumption of noodles followed by Indonesia, Japan and Vietnam (Lee *et al*., 2002) [1].

The changing food habits of children and teenaged groups have created a good market of noodles in India and abroad. The cooking of these noodles is very convenient and requires few minutes. Generally, in the preparation of noodles, wheat flour is in variably used as an important member of blend because the presence of wheat gluten has an added advantage which not only helps in easy extrusion but also gives a smooth and fissure free texture to the noodles. Several other combinations of blends can be explored in the preparation of noodles keeping food values of ingredients and their availability in mind (Eyidemir and Hayta, 2009) [2].

Syzygium cumini, generally recognized as Jamun, is a tropical tree that produces purple ovoid fleshy fruit. The ripe berries are sweetish dry to taste and are useful in preparation of health drinks, jellies, juices, squashes and wine. Its seed has conventionally been used in India for the management of different diseases. Constituents that are reported in the seeds of *Syzgium cumini* are protein (6.3-8.5%), 1.18% fat, 16.9% crude fiber, 21.72% ash, 0.41% calcium, 0.17% phosphorus, fatty acids (palmitic, stearic, oleic and linoleic), fatty oils (30 g/kg), including lauric (2.8%), myristic (31.7%), palmitic (4.7%), stearic (6.5%), oleic (32.2%), linoleic (16.1%), malvalic (1.2%), stercu-lic (1.8%) and vernolic acid (3%) 41% starch, 6.1% dextrin, a trace of phytosterol (β-sitosterol) and tannin (predominantly corilagin, ellagitannins, ellagic acid, gal-loyl-galactoside and gallic acid) (6-19%) (Ranjan *et al*., 2011) [3]. Jamun fruit seeds have been testified to assist various tenacities in diabetic patients, such as depressing blood glucose levels and adjourning diabetic complications including neuropathy and cataracts and jamun fruit lessens the sugar in the blood and hence play important role in the control of diabetes (Helmstadter, 2008) [4]. The seeds of jamun encompass Glucoside, Jamboline and Ellagic acid, which have the ability to check the conversion of starch into sugar when there is excess production of glucose in body (Giri *et al*., 1985) [5]. But very less findings regarding its processing and food uses are available.

On the other hand, the noodles available in the market are prepared from wheat flour which lacks in good quality nutrients. Therefore, the objective of this study was to examine the effect of added jamun seed powder, a waste obtained in excess amounts from jamun processing and rich source of nutrients on cooking, chemical and sensory properties of dried salted noodles.

2. Materials and Methods

2.1 Processing of jamun seed powder

Jamun fruits were got harvested from a private orchard of Jammu. The pulp and seed of jamun fruit were separated by pulper. Then the seeds were washed in water and dried in tray dryer at 60°C for 48 hours till complete drying and ground the seed in pulveriser to fine powder, passed through 20 mesh sieve and packed in air tight containers for further use. Other ingredients viz; wheat flour, salt, oil were purchased from local market.

2.2 Preparation of noodles

The preparation of noodles involved the mixing of wheat flour and dried jamun seed powder in their respective levels by adding optimum water. All these ingredients were mixed properly to get desirable consistency dough. The prepared dough was smeared with a little of refined oil and then it was extruded by the hand extruder through suitable shaped dies. The product was then dried for 6 hours at 50-55 ^{0}C. After drying they were cooled and packed in polyethylene bags and stored under ambient temperature (Bui and Small, 2007) [6]. Flow chart for the preparation of noodles is shown in Fig. 1.

Wheat flour and dried jamun seed powder
↓
Salt water
↓
Mixing
↓
Dough
↓
Extrusion
↓
Noodles
↓
Drying for 6 hrs at 50^{0}C
↓
Packaging

2.3 Storage

The treatment combinations of wheat-jamun seed powder noodles (in triplicate), were packed in low density polyethylene pouches (150 gauge) and then stored for a period of 90 days at room temperature. The stored products were analyzed for physicochemical changes and sensory characteristics at an interval of 30 days.

2.4 Cooking properties of noodles

Optimum cooking time

Optimum cooking time of noodles was evaluated according to method of Singh *et al*. (1989) [7]. The noodle sample (5 g) was inserted in a beaker containing 75 ml distilled water and one strip was crushed between two glasses in every 30 s. The cooking was continued until white fraction in central core of crushed noodles was disappeared and time that passed was recorded as optimum cooking time.

Volume increase

Volume increase was evaluated according to method of Ozkaya and Kahveci (1990) [8]. 25 g noodle was cooked in boiling water (250 ml) on the basis of their optimum cooking time, rested for 5 min and transferred to a beaker fulfilled with 250 ml water. The volume of water over flowed from beaker was recorded. The same procedure was repeated for uncooked noodle as well. The percent volume increase was calculated on the basis of difference between the volume of overflowed water for cooked and uncooked noodles.

Weight increase

Weight increase was evaluated according to Ozkaya and Kahveci (1990) [8]. After cooked and drained noodles were rested for 5 min, the weight was recorded and percent weight increase was calculated on the basis of difference between the weight of cooked and uncooked noodles.

Cooking loss

Cooking loss was evaluated according to method of Ozkaya and Kahveci (1990) [8]. 25 g noodle was cooked in boiling water (250 ml) on the basis of their optimum cooking time. The cooked noodles were drained from funnel and placed cooking beaker again. Cooked and drained noodle washed by adding 90 ml water and drained again. The cooking water was fulfilled with fresh water (350 ml) and mixed completely. Then 50ml of cooking water was transferred into another beaker and dried in an oven at 98^{o}C. The cooking loss was calculated according to following formula:

$$\% \text{ Cooking Loss} = \frac{G \times 28}{100 - W} \times 100$$

G is the weight (g) difference between beakers before and after the drying; and W is noodle moisture.

2.5 Proximate analysis of noodles

Moisture, ash and crude fibre were determined according to AOAC (1995) [9]. Crude protein was estimated by using micro-kjeldahl method, AOAC (1995) [9] using the factor 6.25 for converting nitrogen content into crude protein. For fat content of noodles, 5 g sample was placed in Soxhlet extraction apparatus and subjected to extraction for 6 h using petroleum ether as solvent and percent fat content of noodle samples were calculated on a weight basis. Amount of carbohydrates was calculated from the sum of moisture, crude protein, crude fat, ash and crude fibre and lastly subtracting it from 100 (AOAC, 1995) [9].

2.6 Sensory evaluation of noodles

The samples were evaluated on the basis of colour, texture, taste and overall acceptability by semi-trained panel of 7-8 judges by using 9 point hedonic scale assigning scores 9- like extremely to 1- dislike extremely. A score of 5.5 and above was considered acceptable (Amerine *et al*., 1965) [10].

2.7 Statistical analysis

The data obtained (in triplicate) were evaluated statistically with OPSTAT package program by variance analysis.

3. Results and Discussion

3.1 Cooking properties of jamun seed powder blended noodles

Noodle quality could be estimated from cooking attributes such as cooking loss, volume and weight increase. The effect of jamun seed powder addition on the cooking properties of noodles is presented in Table 1. The control noodle had highest cooking time (11.10 min.) whereas, 10% jamun seed powder added noodles recoded lowest cooking time (9.98 min.). With the increase in addition of jamun seed powder level the cooking time gradually decreased. Ingredients other than wheat flour such as jamun seed powder may cause discontinuity in gluten network (Manthey *et al*., 2004) [11] resulting in faster moisture penetration and therefore, leading to optimum cooking time. The weight increase varied from 141.42 to 174.52%. The value was the highest in control noodle. Izydorczyk *et al*. (2004) [12] also showed that cooked weights of noodles increased when cooking time increased. Volume increase values of cooked noodles varied from 140 to 210%. As the cooking loss is an indicator of noodle's resistance to cooking (Nagao, 1996) [13], low levels are preferable. The cooking loss was the highest in control sample (7.03 %) and lowest was observed in 10% jamun seed powder blended noodles. The results of present study for cooking loss levels agree with Turkish noodle standard which states that cooking loss should not exceed the level of 10% on dry matter basis.

3.2 Proximate composition of jamun seed powder blended noodles

A general increase in moisture content (Table 2) took place during the storage period and it was found that moisture content increased from its initial value 8.74 to 9.11% during 6 months of storage. The maximum mean moisture content of 9.45% was recorded in treatment T_1 (control) and minimum of 8.40 % was observed in treatment T_6 (10% JSP). This might be resulted from the low amount of moisture content in the jamun seed powder. Similar findings have been reported by Slathia *et al*. (2016) [14] in noodles supplemented with germinated mungbean flour. Crude protein content (Table 2) of different treatments decreased during storage period of 90 days from the initial mean value of 11.37 to 11.06% which might be due to breakdown of amino acids (Premlatha *et al*., 2010) [15] during storage. Maximum crude protein content of 11.67 was found in treatment T_1 (control) and minimum of 10.77% in treatment T_6 (10% JSP).

With the advancement of the storage period the mean ash content (Table 3) decreased from the initial level of 0.84 to 0.63% during 6 months of storage. Treatment T_6 (10% JSP) recorded highest mean ash content of 1.04% and lowest (0.43%) was recorded by treatment T_1 (control). This might be due to increased fibre content with the addition of jamun seed powder. Similar results have been reported by Wani and Sood (2014) [16] in cauliflower leaf powder blended biscuits. With the progression of storage period, the fat content (Table 3) decreased from its initial value of 0.76 to 0.64%. The decrease in crude fat content might be due to increase in the activity of lipase enzyme (lipolytic oxidation). The lowest mean crude fat content of 0.52% was reported in treatment T_6 (10% JSP) and the highest of 0.87% was recorded in T_1 (control). Similar results have been reported by Premalatha *et al*. (2010) [15] in the development of high fibre noodles.

The mean crude fibre (Table 4) content during 90 days of storage declined significantly from the initial level of 1.32 to 1.15%. However, with the incorporation of jamun seed powder the crude fibre content increased. Similar results have been reported by Chitra *et al*. (2008) [17] in value added maize and Sharma and Chauhan (2000) [18] with the supplementation of wheat flour with debittered fenugreek flour. It was observed that with the advancement of storage period, the mean carbohydrate content (Table 4) increased from its initial level of 76.96 to 77.41%. Treatment T_6 (10% JSP) recorded highest mean carbohydrate content of 77.74% and lowest (76.66%) was recorded by treatment T_1 (control).

Table 1: Cooking properties of jamun seed powder blended noodles

Treatment	Cooking time (min.)	Weight increase (%)	Volume increase (%)	Cooking loss (%)
T_1 (Control)	11.10	141.42	140.00	7.03
T_2 (2% JSP)	10.91	147.40	157.00	6.92
T_3 (4% JSP)	10.73	149.54	170.00	6.85
T_4 (6% JSP)	10.47	156.60	186.00	6.72
T_5 (8% JSP)	10.25	165.47	195.00	6.54
T_6 (10% JSP)	9.98	174.52	210.00	6.40
Mean	10.57	155.82	176.33	6.74
$CD_{0.05}$	0.09	0.14	0.11	0.13

JSP Jamun Seed Powder

Table 2: Effect of treatment and storage on Moisture (%) and Crude protein (%) of jamun seed powder blended noodles

Treatment	Moisture (%)					Crude protein (%)				
	Storage period (days)					Storage period (days)				
	0	30	60	90	Mean	0	30	60	90	Mean
T_1 (Control)	9.26	9.39	9.52	9.64	9.45	11.83	11.71	11.63	11.50	11.67
T_2 (2% JSP)	9.03	9.17	9.31	9.43	9.23	11.67	11.57	11.46	11.38	11.52
T_3 (4% JSP)	8.85	8.97	9.15	9.28	9.06	11.45	11.34	11.28	11.19	11.31
T_4 (6% JSP)	8.63	8.75	8.89	8.97	8.81	11.26	11.20	11.09	10.93	11.12
T_5 (8% JSP)	8.47	8.56	8.72	8.73	8.62	11.09	10.90	10.82	10.74	10.89
T_6 (10% JSP)	8.19	8.33	8.47	8.61	8.40	10.92	10.86	10.70	10.62	10.77
Mean	8.74	8.86	9.01	9.11		11.37	11.26	11.16	11.06	

Effect	$CD_{0.05}$	$CD_{0.05}$
Treatment	0.04	0.02
Storage	0.05	0.03
Treatment x Storage	NS	NS

JSP Jamun Seed Powder

Table 3: Effect of treatment and storage on Ash (%) and Crude fat (%) of jamun seed powder blended noodles

Treatment	Ash (%)					Crude fat (%)				
	Storage period (days)					Storage period (days)				
	0	30	60	90	Mean	0	30	60	90	Mean
T_1 (Control)	0.53	0.46	0.40	0.33	0.43	0.93	0.90	0.85	0.81	0.87
T_2 (2% JSP)	0.69	0.61	0.54	0.46	0.58	0.87	0.85	0.81	0.77	0.82
T_3 (4% JSP)	0.78	0.73	0.66	0.58	0.69	0.80	0.78	0.74	0.70	0.75
T_4 (6% JSP)	0.89	0.81	0.73	0.67	0.77	0.73	0.70	0.65	0.61	0.67
T_5 (8% JSP)	1.01	0.95	0.88	0.81	0.91	0.66	0.63	0.59	0.52	0.60
T_6 (10% JSP)	1.14	1.08	1.02	0.91	1.04	0.58	0.55	0.51	0.46	0.52
Mean	0.84	0.77	0.70	0.63		0.76	0.73	0.69	0.64	

Effect	$CD_{0.05}$	$CD_{0.05}$
Treatment	0.04	0.05
Storage	0.03	0.04
Treatment x Storage	0.08	0.09

JSP Jamun Seed Powder

Table 4: Effect of treatment and storage on Crude fibre (%) and Carbohydrates (%) of jamun seed powder blended noodles

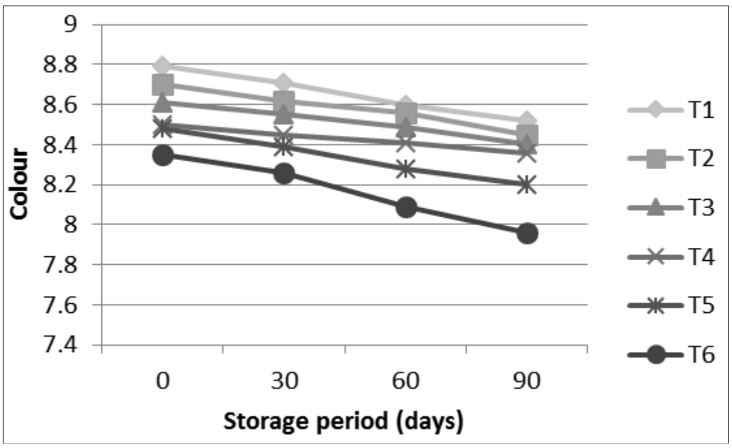
Treatment	Crude fibre (%)					Carbohydrates (%)				
	Storage period (days)					Storage period (days)				
	0	30	60	90	Mean	0	30	60	90	Mean
T_1 (Control)	0.98	0.94	0.91	0.85	0.92	76.47	76.60	76.69	76.87	76.66
T_2 (2% JSP)	1.15	1.11	1.07	1.01	1.09	76.59	76.69	76.81	76.95	76.76
T_3 (4% JSP)	1.27	1.20	1.16	1.09	1.18	76.85	76.98	77.01	77.16	77.00
T_4 (6% JSP)	1.40	1.35	1.31	1.24	1.32	77.09	77.19	77.33	77.58	77.30
T_5 (8% JSP)	1.52	1.46	1.40	1.33	1.43	77.25	77.50	77.59	77.87	77.55
T_6 (10% JSP)	1.63	1.58	1.49	1.38	1.52	77.54	77.60	77.81	78.02	77.74
Mean	1.32	1.27	1.22	1.15		76.96	77.09	77.21	77.41	

Effect	$CD_{0.05}$	$CD_{0.05}$
Treatment	0.03	0.04
Storage	0.02	0.03
Treatment x Storage	0.06	0.08

JSP Jamun Seed Powder

3.3 Sensory characteristics of jamun seed powder blended noodles

The effect of jamun seed powder addition on sensory properties of noodles is shown in Figure 1. Noodles had lower sensory scores for colour, texture and overall acceptability when jamun seed powder addition level was increased. The highest mean score for colour was 8.52 in T_1 (control). The colour score declined with the increase in percentage of incorporation of jamun seed powder. This might be attributed to the higher concentration of jamun seed powder which imparted slight darker colour to the product. 8% jamun seed powder added noodles had the highest score for taste (8.43) after 90 days of storage. With progression of storage period and incorporation of jamun seed powder the texture score declined. The overall acceptability values varied from 7.77 to 8.62. The overall acceptability values decreased as jamun seed powder incorporation increased and the lowest value was obtained for 10% jamun seed powder added noodles. Similar results have been reported by Thorat and Khemnar (2013) [19] in jamun seed powder fortified cookies.



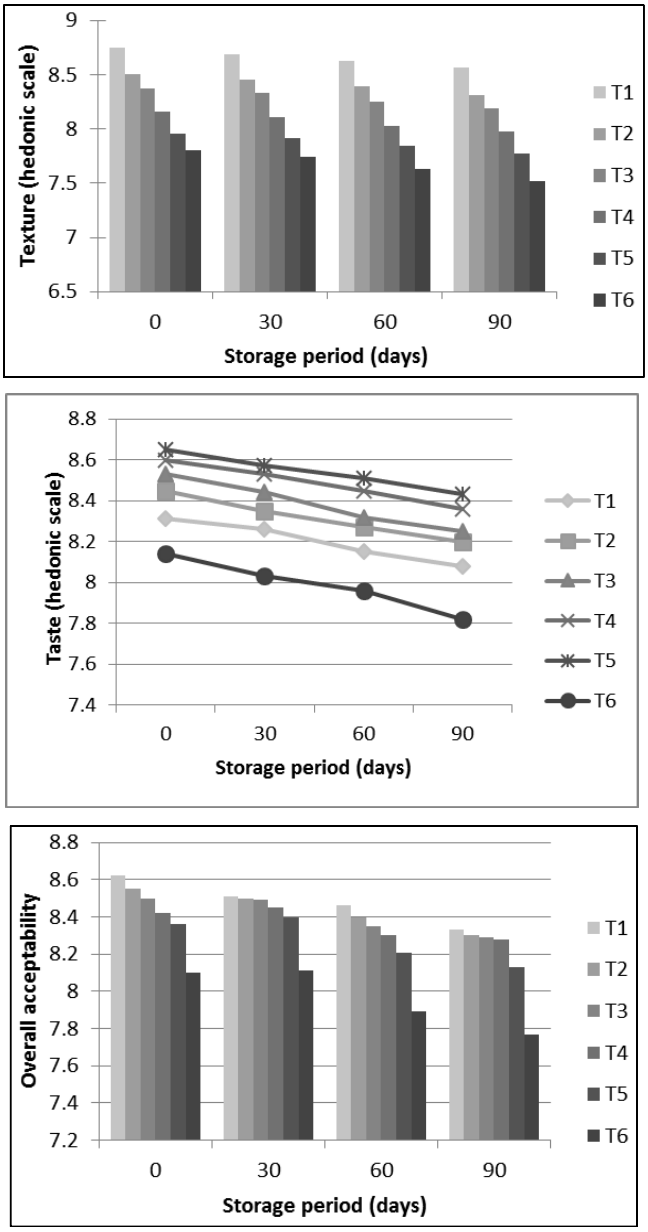


Fig 1: Sensory characteristics of jamun seed powder blended noodles

4. Conclusion

It can be concluded from the study that the blending of jamun seed powder had significant effect on cooking, proximate and sensory properties of noodles. Increasing the level of jamun seed powder in the noodle formulation resulted in noodles with a higher ash and crude fibre content. Blending upto 8% was acceptable for the preparation of best quality noodles. Development of such type of products is also advantageous for consumers seeking alternative products containing healthy ingredients.

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